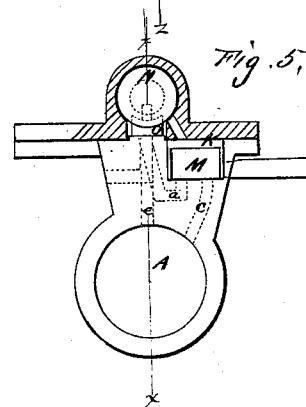
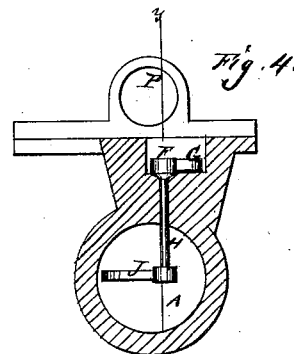
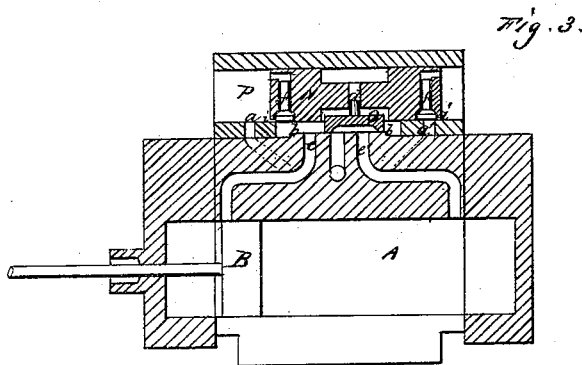
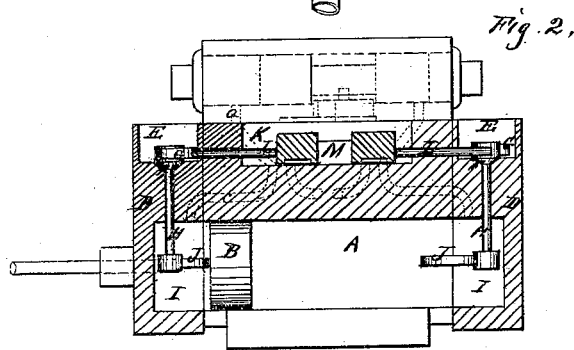
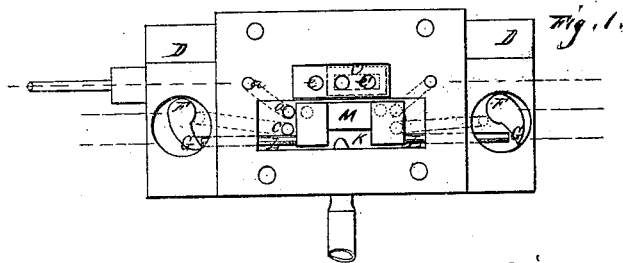


W. D. Hooker,

Slide Valve.

No. 109,904

Patented Dec. 6. 1870.



Witnesses.  
Geo. H. Strong  
A. D. Dwyer

Inventor.  
Wm. D. Hooker.

# UNITED STATES PATENT OFFICE.

WILLIAM DAVIS HOOKER, OF SAN FRANCISCO, CALIFORNIA.

## IMPROVEMENT IN DIRECT-ACTING STEAM-ENGINES.

Specification forming part of Letters Patent No. 109,904, dated December 6, 1870.

*To all whom it may concern:*

Be it known that I, WILLIAM DAVIS HOOKER, of the city and county of San Francisco, State of California, have invented an Improved Direct-Acting Steam-Engine; and I do hereby declare the following description and accompanying drawings are sufficient to enable any person skilled in the art or science to which it most nearly appertains to make and use my said invention or improvement without further invention or experiment.

My present invention relates to an improvement in direct-acting steam-engines, by which I am enabled to start the piston from any point in the stroke, there being no dead-point.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is a plan, showing the main valve-face and the auxiliary valve. Fig. 2 is a vertical section of the cylinder, passing through the auxiliary valve and chamber in the planes *y* and *z*. Fig. 3 is a vertical section taken through *x*, Fig. 1. Figs. 4 and 5 are transverse sectional views of the cylinder and the valve-chambers.

A is the steam-cylinder, and B is the piston. D D are two heads, so formed that their upper faces shall be flush with the top of the auxiliary valve-chamber, which lies above and to one side of the center of the cylinder.

Chambers E are made in the heads D, and within these are placed the valves F, which are ground to fit their seats.

An arm, G, projects out at one side of the valve, and a stem, H, extends down from the valve into the chamber I in the head D, or it may pass directly into the end of the cylinder.

A curved arm or cam, J, is fastened to this stem, so that as the piston arrives at one end or the other, it will strike one of the cams, and rotate the valve F, to which it is attached, thus moving the arm G forward.

A hole is made from the chamber E to the auxiliary valve-chamber K, and a short rod or stem, L, passes loosely through the hole, so that when the arm G moves forward it pushes the rod L, and by its movement forces the auxiliary valve M to the end of its chamber, thus opening the two ports *a* and *c*.

The steam which passes through the hole

beside the rod L serves to hold the valve F firmly to its seat. The port *a* communicates with the upper cylinder, and the port *c* opens into the main cylinder, as will be hereinafter described.

The main valve O moves on the face *b*, and has a stem, *d*, projecting upward into an opening in the piston N. This latter piston moves in a cylindrical chamber, P, above the valve O, but having an opening communicating with it through which the stem *d* passes.

The steam from the chamber K (into which it first enters) passes through the opened port *a*, and, entering the chamber P, forces the piston N to the end of its chamber, carrying with it the valve *o*, so that the main steam-port *e*, and also the exhaust-port, are opened.

The steam which was admitted to the main cylinder through the port *c* serves to cushion the piston, and prevents its striking the end of the cylinder. It also serves, with the steam from the port *e*, to drive the piston to the opposite end of the cylinder.

When the auxiliary valve M was moved, as described, so as to admit steam to one end of the valve-chamber P, it also opened the exhaust-port *a'* from the opposite end, so that the steam from that end could escape and allow the piston N to move freely.

This piston has a small valve, *f*, operating at each end, as shown, and as the piston N passes over the exhaust-port, the steam which remains in the end of the chamber will enter the opening above the valve *f*, and close it tightly over the exhaust-port. This causes the piston N to be cushioned at each end of its stroke.

When steam is again admitted to move the piston N in either direction, it will raise the valve *f*, and a sufficient quantity to start the piston N will escape through the small space *i* at the bottom, and enter the chamber P behind the piston N.

By constructing any engine in this manner, I am enabled to make all the valve motions positive and dependent upon the movement of the piston.

There will be no dead-point, and the engine can be started from any point in its stroke by letting in the steam.

The valves F being ground to their seats, will fit closely, and not permit any leakage of

steam, so as to derange the action of the engine. I am also enabled to make the motion of the auxiliary valve very short, in comparison with that of the main piston.

Having thus described my invention, what I desire to secure by Letters Patent is—

1. The valve F with its cams or arms G and J, in combination with the main and auxiliary valve and main piston of a direct-acting engine, substantially as herein described.

2. The valves *f* and passage *i* in the piston N, together with the ports *a a'* and the auxiliary valve M, substantially as and for the purpose described.

3. In combination with the valve F and the valve M, the ports *c*, to arrest and cushion the main piston at the end of its stroke, substantially as herein described.

In witness that the above-described invention is claimed by me I have hereunto set my hand and seal.

WM. DAVIS HOOKER. [L. S.]

Witnesses:

WM. GERLACH,  
G. FITZGERALD.